CLAIMS

Sub a6

1. A print head apparatus, comprising:

a substrate;

an ink expulsion mechanism provided on said substrate; and

a first pressure sensor that is capable of detecting a signal related to a misfiring of said ink expulsion mechanism.

2. The apparatus of claim 1, wherein said sensor includes piezoelectric material.

3. The apparatus of claim 1, wherein said sensor is formed on said substrate.

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4. The apparatus of claim 1, further comprising:

a barrier layer formed on said substrate;

a cover plate having a nozzle therein formed on said barrier layer and positioned such that said nozzle is aligned with said ink expulsion mechanism, said substrate, barrier and cover plate defining an ink well; and

wherein said first sensor is provided at said ink well in such a manner as to detect pressure waves propagating in ink in said ink well caused by a misfiring of said ink expulsion mechanism.

5. The apparatus of claim 1, wherein said first pressure sensor is an acoustic wave piezoelectric transducer.

6. The apparatus of claim 1, wherein said first pressure sensor is an interdigitated pressure wave transducer.

~~7.~~ 8. The apparatus of claim 1, further comprising a second pressure sensor, wherein said first pressure sensor is an acoustic wave piezoelectric transducer and said second pressure sensor is an interdigitated pressure wave transducer.

~~8.~~ 9. The apparatus of claim 1, wherein said ink expulsion mechanism is thermally actuated.

~~9.~~ 7. The apparatus of claim 6, further comprising a second pressure sensor that is an interdigitated pressure wave transducer and said first sensor and said second sensor are provided in a substantially orthogonal arrangement on said substrate.

Sub 98

10. A print head apparatus, comprising:

a substrate;

an ink expulsion mechanism formed on said substrate;

a cover plate spaced from said ink expulsion mechanism and having a nozzle formed therein, said nozzle being aligned with said ink expulsion mechanism; and

a sensor mechanism that is capable of determining when said nozzle is clogged.

11. The apparatus of claim 10, wherein said sensor mechanism is capable of determining when said nozzle is unclogged.

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12. The apparatus of claim 10, wherein said sensor mechanism is capable of determining one or more of the group of conditions including dry-fire and no-fire conditions.

13. The apparatus of claim 10, wherein said sensor is a pressure sensor.

14. The apparatus of claim 13, wherein said sensor includes piezoelectric material.

15. The apparatus of claim 10, wherein said sensor includes one or more of the group of sensors including an piezoelectric acoustic wave transducer and an interdigitated pressure wave transducer.

Sub a9

16. The apparatus of claim 10, wherein said sensor mechanism is capable of detecting a magnitude and timing of a pressure wave generated by a firing of said ink expulsion mechanism.

17. A method of monitoring performance of a print head, comprising the steps of:

attempting expulsion of a volume of ink from a print head;

detecting within said print head a characteristic of a pressure wave generated by said attempt to expel said volume of ink.

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18. The method of claim 17, further comprising the step of determing from said detected characteristic a status of said attempted expulsion of said volume of ink.

19. The method of claim 17, wherein said detecting step includes the step of detecting the presence or absence of a pressure wave.

20. The method of claim 17, wherein said detecting step includes the step of detecting a magnitude and timing of said pressure wave.

21. The method of claim 20, wherein said detecting step further comprises the steps of establishing a first magnitude related to an expulsion of said volume of ink and detecting a second magnitude in the range of 15% to 25% less than said first magnitude.

22. The method of claim 20, wherein said detecting step further comprises the steps of establishing a first timing of said pressure wave related to an expulsion of said volume of ink and detecting a second timing in the range of 15% to 20% earlier than said first timing.

23. A printhead for an inkjet printing apparatus comprising:

a substrate;

at least one ink ejector disposed on said substrate;

an interdigitated pressure wave transducer disposed on said substrate and having a directional detection characteristic whereby a pressure wave traveling in a

predetermined direction from said at least one ink ejector is preferentially detected.

24. A printhead in accordance with claim 23 further comprising a second interdigitated pressure wave transducer disposed on said substrate and having a directional detection characteristic oriented such that a pressure wave traveling in a second direction different than said predetermined direction is preferentially detected.

25. A printhead in accordance with claim 24 wherein said second direction is orthogonal to said predetermined direction.

26. A method of detecting a misfiring nozzle in an inkjet printhead comprising the steps of:

establishing a first magnitude of a pressure wave corresponding to an ejection of a predetermined volume of ink from a nozzle; and

detecting a second magnitude of a pressure wave in the range of 15% to 25% less than said first magnitude whereby a misfiring nozzle may be detected.

27. A method of detecting a misfiring nozzle in an inkjet printhead comprising the steps of:

establishing a first timing of an arrival of a pressure wave from an ejection of a predetermined volume of ink from a nozzle; and

detecting a second timing of an arrival of a pressure wave in the range of 15% to 20% earlier than said first timing whereby a misfiring nozzle may be detected.

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